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THE AMERICAN
JOURNAL OF PHARMACY

APRIL, 1916

THE PHARMACIST AS THE FUTURE MUNICIPAL CHEMIST AND BACTERIOLOGIST.

By C. FERDINAND NELSON, Associate Professor of Physiological Chemistry, University of Kansas, School of Pharmacy.

Among the many brilliant achievements of the nineteenth century, the development of the sciences of chemistry and bacteriology is by no means least. Especially noteworthy from a practical point of view have been the adaptations by means of countless methods and procedures of the data of these sciences so that we now have within them separate and distinct departments of endeavor, whose sole concern lies in the application of chemical and bacteriological methods to the problems of daily life. In the industries and in business we find a decided trend toward the adoption of definite checks on the purity, composition, value, and reliability of raw and finished products, and these checks are largely chemical or bacteriological in nature. In the practice of medicine physicians are increasingly desirous of having their diagnoses verified by chemical and bacteriological analyses. In sanitary and public health work bacteriological and chemical methods have become indispensable.

I think it perfectly safe to say that there exists to-day a vast latent demand for the services of men and women having chemical and bacteriological training, particularly those who possess also some business ability. *Now why should the pharmacist not use his chemical information in some definite and constructive way—why should he forget that he has learned something besides the Latin name for tincture of ginger, whisky, poke-root, and how to compound a prescription containing, say, sodium chloride, boric acid, and camphor water? If that is all there is to the profession of pharmacy, there is no glory in it and we have no business to recommend it to the bright young man of to-morrow.*

But it is not alone in private business that this desire of being able to obtain chemical and bacteriological data is felt. Our municipalities are becoming interested in the question. As public corporations they need to avail themselves of modern methods. The health officer needs the services of a chemist and bacteriologist. The community milk supply needs to be watched and the milk subjected to frequent analysis. The water supply should be examined and samples of water analyzed at regular intervals. Infected areas can be easily determined and controlled where bacteriological data can easily be had. Sewage disposal can be safeguarded. In short, in order to adequately protect the public health, it becomes almost imperative that laboratories, where chemical and bacteriological analyses can be made, be established in each municipality.

Now it is precisely here where the pharmacist can be of service to his community, can elevate his calling, can check the inroads which commercialism has made in his profession, and at the same time open up a field yielding him splendid financial returns. *The civic laboratory is bound to come, for the city, for the town, even for the village.* The pharmacist is already established in all of these communities; he has his stock of chemicals, his store, his technical education. Why is he not the very man to run for the office of city chemist and bacteriologist? Why should he not step in and help the physician preserve the public health? Why should he not speak as authoritatively on matters chemical and bacteriological as the average physician now does on sanitation, infection, and the other numerous phases of public health work?

The progressive pharmacist should anticipate these opportunities; he should prepare and equip himself for the demands of the future, and not sit idly by and have things slip out of his hands, literally go by default. *When it comes to professional matters, we have more inertia than a ten-ton bowlder. What about our professional momentum and energy?* A bacteriological and chemical outfit, aside from what a pharmacist already has in his store, will cost him less than $500. Ten feet of space in the front part of the store fitted up as a neat laboratory far surpasses a soda fountain as an advertising medium. If he spends as much energy developing a department of this sort as he frequently does in selling sundries, his returns for analyses other than those done for the municipality will yield him far greater revenues.

A METRICAL TRAGEDY.*

By Dr. Jos. V. Collins, Stevens Point, Wis.

The war in Europe has opened up a large field of trade in South America. Three things especially stand in the way of its development, viz., the absence of a proper credit system, the failure to make goods of the kind demanded, and, third, the use of our antiquated system of weights and measures, all the South American countries employing the metric system. Of these three obstructing influences, the first two are in a fair way to be obviated soon; not so the last.

It is the use by our modern progressive country of an ancient system of weights and measures which it is here proposed to discuss and show up as an absurdity. Our present system is organized and set forth in arithmetics under some fifteen so-called "tables." These tables are all different and there is no uniformity in any one table. Only one unit suggests convenience in reductions, viz., hundredweight. It is easy to reduce from pounds to hundredweight and *vice versa*. Some fifty ratio numbers have to be memorized or calculated from other memorized numbers to make the common needed reductions. History shows that ancient Babylonia had tables superior to those now in use, and ancient Britain a decimal scale which was crowded out by our present system.

The metric system of weights and measures was developed in France about 1800 and has come to be employed over all the civilized world except in the United States, Great Britain and Russia. The system was legalized in the United States in 1866 but not made mandatory, and here we are fifty years later using the old system, with most of the civilized world looking on us with more or less scorn because of our belatedness.

In this age everywhere the cry is efficiency, always more efficiency. Ten thousand improvements and labor-saving devices are introduced every day. But here is an improvement and labor-saving device which would affect the life of every person in the land and in many instances greatly affect such persons' lives, and yet almost no one really knows anything about the matter.

So let us now consider the good points in the metric system (each implying corresponding elements of great weakness in the common

* *The Scientific Monthly*, vol. i, No. 3, 1915. p. 256.

system), and then study briefly what stands in the way of its adoption in this country. These good points are:

First, the metric units have uniform self-defining names (cent, mill, metre and five more out of the eleven terms used already familiar to us in English words), are always the same in all lands, known everywhere, and fixed with scientific accuracy.

Second, every *reduction* is made almost instantaneously by merely moving the decimal point. There are no reductions performed by multiplying by 1,728 or 5,280, etc., or dividing by 5½, 30¼ or 31½, etc., and hence there is *a great saving* in the labor and time of making necessary calculations.

Third, there are but *five* tables in the metric system proper, these taking the place of from twelve to fifteen in our system (or lack of it). These are linear, square, cubic, capacity and weight.

Fourth, any one table is about as easy to learn as our United States money table, and after one is learned, it is much easier to learn the others, since the same prefixes with the same meanings are used in all.

Fifth, the weights of all objects are either known directly from their size, or can be very quickly found from their specific gravities.

Sixth, the subject is made so much easier for children in school that a conservative expert estimate of the saving is two-thirds of a year in a child's school life. The rule in this country is eight years of arithmetic, the arithmetic occupying about one-fourth of the child's activity. With metric arithmetic substituted for ours, what it now takes two years to prepare for, could be easily done in 1⅓ years. This involves an enormous waste of money and energy every twelve-month.

Seventh, only *one* set of measures and *one* set of weights are needed to measure and weigh everything, and *one* set of machines to make things for the world's use. There would be no duplication of costly machinery to enter the foreign trade field, thus securing enormous saving. It is well known that the United States and Great Britain have lost a vast amount of foreign commerce in competition with Germany and France, because of their non-use of the metric units. Britain realizes this and is greatly concerned over the situation.

Eighth, every ordinary practical problem can be solved conveniently on an adding machine. Our adding machines are used almost solely for United States money problems.

Ninth, no valuable time is lost in making reductions from common to metric units, or *vice versa,* either by ourselves or foreigners. To make our sizes in manufactured goods concrete to them foreign customers have to reduce our measures to theirs, and this is a weariness to the flesh.

Tenth, the metric system is wonderfully simple. All the tables with a rule to make all possible reductions can be put on a postal-card.[1]

The metric weights and measures constitute *a scientific system;* our weights and measures are a *disorganization.* Naturally one can expect a *great saving of time, thought and labor* from the use of a system, and this is the fact. If one dared introduce ordinary arithmetical problems into an article like this, it would be easy to show by examples how a person has to be something of a master of common fractions in order to solve in our system common every-day problems, whereas in the metric system nearly everything is done very simply with decimals. In our system a mechanic after making a complicated calculation with common fractions is as likely as not to get his result in sixths or ninths, etc., of an inch, whereas his rule reads to eighths or sixteenths, and he must reduce his sixths or ninths to eighths or sixteenths before he can measure off his result. In the metric system results always come out in units of the scale used. The metric system measures to millimetres or to a unit a trifle larger than a thirty-second of an inch. In our system one is likely to avoid sixteenths or thirty-seconds on account of the labor of calculation. Then, besides, the amount of figuring is so much less in the metric system. Take the case of a certain problem to find the cubical contents of a box. Our solution calls for 80 figures and the metric for 35, and this is a typical case, not one specially selected. Thus, metric calculations, while only from one-third to two-thirds as long, are likely to be two or three times as accurate, are far easier to understand, and the results can be immediately measured off. Hence, we waste time in these four ways. Shakespeare, in *Hamlet,* says: "Thus conscience does make cowards of us all." In like vein it might be said: Thus custom (in weights and measures) doth make April fools of us all. It is no exaggeration to say that counting grown-ups solving actual problems and children solving problems in school we are sent on much more than a billion such April fool errands round Robin Hood's barn every year.

[1] See article by the writer in *Education* (Boston), Dec., 1894.

Noting how much time is saved in making simple everyday calculations by using the metric system, suppose that we assume of the 60 or more millions of adults in active life in this country, on the average only one in 60 makes such calculations daily and that only twenty minutes' time is saved each day. Let us suppose that the value of the time of the users is put at $2.40 per day, or 10 cents for 20 minutes. Then 1,000,000 users would save $100,000 per day, or $30,000,000 per year. But perhaps some one is saying that much of this time is not really saved, since many persons are paid for their time and can just as well do this work as not. The answer to this is that in many instances such calculations take the time of *others* as well as the person making the calculation. Occasionally a contractor might hold back or work to a disadvantage a gang of a score of workmen while trying to solve a problem that came up unexpectedly.

An estimate of the value of all weighing and measuring instruments places the sum at $150,000,000. Thus, we see that in five years, merely by a saving in *time*—for time is money—all metric measuring and weighing instruments could be got *new* at no extra expense. This estimate of the cost of replacing our weighing and measuring instruments by new metric ones and of saving time has been made by others with a similar result.

A matter of very much more importance than that just discussed is the extra unnecessary expense put upon education, viz., two-thirds of a year for every child in the land. Presumably if the metric system were in use with us, all our children would stay in school as long as they now do, thus getting two-thirds of a year farther along in the course of study. Actually, if arithmetic were made more simple, vast numbers would stay longer, since they would not be driven out of school by the terrible inroads on their interest in school work by dull and to them impossible arithmetic. If metric arithmetic texts were substituted for our present texts, it is safe to say children would average one full year more of education. What the increased earning power would be from this it would be hard to estimate, but clearly it would be a huge sum.

Consider also how much more life would be worth living for children, teachers and parents if a very large portion of arithmetical puzzles inserted to qualify the children to understand our crazy weights and measures were cut out of our text-books. If we were to adopt the metric system, literally millions of parents would be spared worry, and shame, and fear lest Johnny fail and drop out of

school, or Mary show unexpected weakness and have to take a grade over again; uncounted thousands of teachers would be saved much gnashing of teeth and uttering of mild feminine imprecations under their breath; and, best of all, the children themselves would be saved from pencil-biting, tears, worries, heartburns, arrested development, shame and loss of education!

A committee of the National Educational Association has recently reported that Germany and France are each two full years ahead of us in educational achievement; that is, children in those countries of a certain age have as good an education as our children who are two years the foreign children's seniors. Surely one of these years is fully accounted for by the inferiority of our American *arithmetic* and *spelling*. This much, at least, of the difference is neither in the children themselves, nor in the lack of preparation of our teachers, nor in educational methods.

Professor J. W. A. Young, of the University of Chicago, in his work on "Mathematics in Prussia," says: "In the work in mathematics done in the nine years from the age of nine on, we Americans accomplish no more than the Prussians, while we give to the work seven-fourths of the time the Germans give." Professor James Pierpont, of Yale, writing in the *Bulletin* of the American Mathematical Society (April, 1900), shows a like comparison can be made with French instruction. Pierpont's table exhibits only one hour a week needed for arithmetic for pupils aged 11 and 12! As the advertisements sometimes say, there must be a reason.

But if the children are kept in school two-thirds of a year longer somebody pays for this extra expense. Now children do not drop out of school until they are about 12 years of age and have both appetites and earning power. The number of these children that drop each year is probably about 2½ millions. Of this number let us say 1½ millions would become wage earners, thus passing from the class that are supported to the class that support themselves and earn a small wage besides. We have then three items in this count: (1) The cost to the state in taxes for the education of 2½ millions for two-thirds of a year, or $50,000,000; (2) the cost to the parents for support of 1½ millions for two-thirds of a year at $67 each, or $100,000,000; (3) the wages of 1½ millions over and above the cost of their support, say $50 each, or $75,000,000.

The above figures are put low purposely so that they cannot be

criticised. It should be remembered that 46 per cent. of our population is agricultural, and that on the farm, youths of from 13 to 15 very often do men's and women's work; also that in many manufacturing centres great numbers of children get work at relatively good wages, and that the number of completely idle children out of school is not large.

With these figures in hand let us consider now a kind of debit and credit sheet against and for our present system of weights and measures.

PRESENT SYSTEM OF WEIGHTS AND MEASURES.

In *annual* account with UNCLE SAM

Dr.		Cr.	
To cost in school taxes of keeping 2½ millions of children in school ⅔ year	$50,000,000	By culture (?) acquired by the children through learning more common fractions and our crazy tables of weights and measures	$?
To cost to parents for supporting 1½ million children ⅔ year	100,000,000		
To loss of productive power of 1½ million youths for ⅔ year	75,000,000		
To loss of earning power by having children driven out of school by difficulties of arithmetic as now taught	25,000,000		
To loss of time in making arithmetical calculations by men in trade, industries and manufactures	30,000,000		
To extra weighing and measuring instruments needed for sundry tables.	10,000,000		
To loss of time in making cross reductions to and from our system and metric system	5,000,000		
To loss of profit from foreign trade because our goods are not in metric units	20,000,000		
Total annual loss	$315,000,000		

Commenting for a moment on the credit side of the above ledger account, it can be said that recent psychology shows conclusively that training in common fractions and weights and measures cannot be of much practical help as so-called culture, or training for learning other things, unless those other things are closely related to them, and there are not many things in life so related to them once we had dropped our present weights and measures.

It may be complained that the expense of changing to the new system is not taken account of in the above table. The reason is that that expense would occur once for all. The above table deals with the *annual* cost of our present mediæval system.

One powerful reason for the adoption of the metric system different in character from the others is the ease of cheating by the old system. In the past the people have been unmercifully abused through short weights and measures. Many of the states have taken this matter up latterly and prosecuted merchants right and left. Nine-tenths of this trouble would disappear with the new system in use.

Let us consider now for a little time the reasons why the metric system has not been accepted and adopted for use in the United States. Evidently the great main reason has been that the masses of the people, in fact all of them except a very small educated class in science, are almost totally uninformed on this whole question. Such articles as have been published have almost invariably appeared in either scientific, technical or educational magazines, mostly the first, so that there has been no means of reaching the masses, or even the school teachers, with the facts. For another reason, the United States occupies an isolated position geographically, and our people do not come into personal contact with those in other countries using the metric system. But there is still another potent reason. After the United States Government legalized the metric system in 1866, all the school books on arithmetic began presenting the topic of the metric system, and, quite naturally, they did it by comparing its units with those of our system and calling for cross reductions from one system to the other. No better means of sickening the American children with the metric system could have been devised. Multitudes of the young formed a strong dislike for the foreign system with its foreign names, and could not now be easily convinced that it is not difficult to learn. Every school boy knows how easy it is to learn United States money. The boy just naturally learns it between two nights. The whole metric system *under favorable conditions* is learned nearly as easily. By favorable conditions is meant the constant use of the system in homes, schools, stores, etc. These favorable conditions, of course, we have never had.

In 1904 an earnest effort was made again both in this country and Great Britain to have the metric system adopted for general use. The exporting manufacturers in both countries grew much concerned

over the whole situation. A petition to have the metric system adopted in Great Britain was signed by over 2,000,000 persons. A bill to make the system mandatory was passed by the House of Lords and its first reading in the House of Commons. The forces of conservatism then bestirred themselves and the bill was held up. Foreseeing a movement of the same kind in this country, the American Manufacturers' Association got busy, laid plans to defeat such movement, which they later did. Strictly speaking, this action was not taken by the association as such but only by a part of it. One-fourth of the membership and probably much more than a fourth of the capital of the association were on the side for the adoption of the system. Politically, however, the side opposed to the new system had altogether the most influence.

Careful study of the whole matter showed that the main cost to make the change to the new system would be in dies, patterns, gauges, jigs, etc. A careful estimate put this cost at $600 for each workman, and, assuming a million workmen, we have a total cost of $600,000,000. But we have just seen that the annual expense of retaining the old system of weights and measures is over $300,000,000. Thus we see that two short years would suffice to pay for what seems to the great manufacturers' association an insuperable expense. From all this we see that the question is not one for N. M. A. bookkeeping, but for national bookkeeping.

Many well informed people studying the matter superficially think the difficulties in the way of a change to the new system insurmountable. Thus, they think of the cost to the manufacturer—which we have just seen to be rather large but not insurmountable; they think of the changes needed in books, records, such as deeds, and the substitution of new measuring and weighing instruments. Germany and all the other countries of continental Europe made the change. Are we to assume that the United States cannot? That would be ridiculous. Granting that commerce has grown greatly; so also have intelligence and capability of the people for doing great things.

Scientists are universally agreed as to the wisdom of the adoption of the metric system. The country, as a whole, must be educated up to the notion that sooner or later it is sure to be universally adopted, that it is only a question of time when this will be done. Already electrical, chemical and optical manufacturing concerns use the metric units and system exclusively. The system is also used widely in medicine and still other arts. Then all institutions of learning use

the metric system exclusively whenever this is possible. All that is needed is to complete a good work well begun.

There is one rational objection to the metric system and but one. It is that 10 is inferior to 12 as a base for a notation for numbers, but the world is not ready to make this change, nor is it likely to be for generations to come. Moreover, this improvement is far less important than uniformity in weights and measures. For these reasons this objection can be passed over. Men said the metric system would never be used outside of France; but it has come to be used all over the world. The prophets said we should never have uniformity as regards a reference meridian of longitude. But we have. And so it will be with the adoption of the metric system in the United States and Great Britain. It is only a question of whether it comes sooner or later. When that day comes, the metre, a long yard, will replace the yard; the litre, the quart (being smaller than a dry and larger than a liquid quart); the kilogramme will replace the pound, being equal to 2.2 pounds, and the kilometre (0.6 mi.) will replace the mile. Within a week or so after the change has been made to the new system, all men in business will be reasonably familiar with the new units and how they are used, and within a few months every man, woman and child will be as familiar with the new system as they ever were with the simplest parts of the old—so easy it will be to make the change, so far as ordinary business affairs are concerned. However, for exact metal manufacturers years will be needed to fully change over to the new. Here the plan is to begin with new unit constructions and new models, as automobiles using new machinery constructed in the integral units of the metric system. All old constructions are left as they are and repaired as they are. This was the plan used in Germany and of course it works.

In conclusion it can be said that we started with the idea that the change to the metric system was needed for the sake of foreign commerce. We now see that we need it also for our own commercial and manufacturing transactions. If we are to have the efficiency so insistently demanded by the age in which we live, then we must have the metric system in use for the ordinary affairs of daily life of the masses of the people, we must have it in commercial and manufacturing industries, and we must have it in education. If efficiency is to be the slogan, then the metric system must come, no matter what obstacles stand in its way.

SOME RELATIONS OF PLANTS TO DISTILLED WATER AND CERTAIN DILUTE TOXIC SOLUTIONS.[1]

By M. C. MERRILL.

(*Continued from p. 82.*)

It will be noted that both represent the conductivity curve of distilled water containing the roots of seedling peas. The difference mentioned no doubt finds its explanation in the different conditions under which the two series were grown (the series for fig. 2 being run in the fall when the seeds were fresh, and that for fig. 3 in the winter), in the vigor of the seeds, and in the difference in the units used in plotting the curves. It must be said, however, that various factors of the problem of exosmosis from the roots of plants remain as yet unknown.

The early drop in the curve of the conductivity of the controls (1–4) is an interesting feature which would seem to be explained by an adsorption of the electrolytes on the surface of the chemically clean glass tumblers.

At the end of 20 days in distilled water the roots of the plants which had not been in full nutrient at all showed marked deterioration (being badly decomposed and covered with a gelatinous coating), while the roots of those which had previously been in full nutrient solution for some time remained normal in every respect, even after 20 days in distilled water.

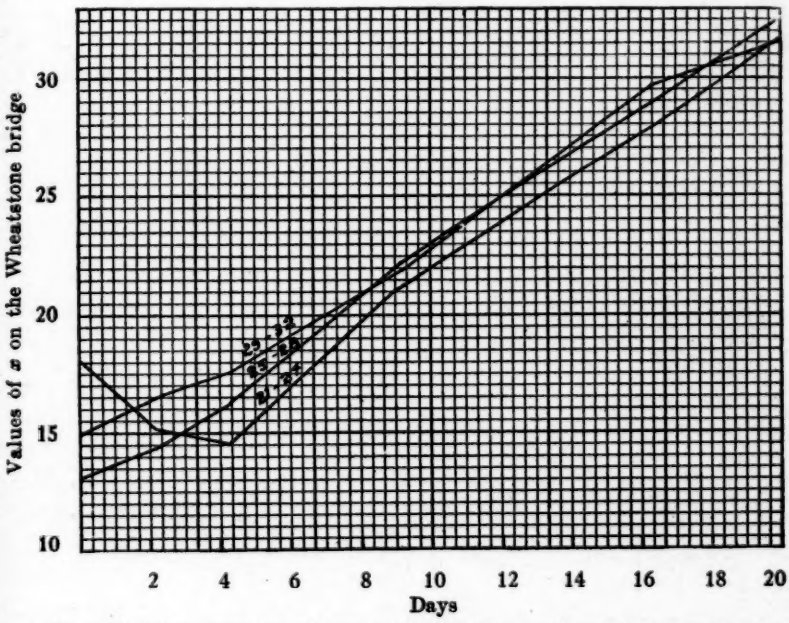
These results seem plainly to indicate that injury which plants sustain in distilled water is very closely related either to the lack of available nutrients in the medium or of reserve food material in the tissues. A seedling is in an exceedingly plastic state of growth. If no food materials become available the embryonic tissues which are in such an active condition of growth soon become disorganized, possibly suffering partial autolysis and becoming the prey to bacterial and fungous action. We would expect, therefore, that the larger the seeds (and hence also the supply of stored materials), the longer the seedlings could remain in distilled water before deterioration. Comparison of True's results on *Lupinus* with those here presented on *Pisum sativum* and *Vicia faba* seems to fulfil that expectation. We should also expect that the more nutrient materials the plant absorbed, the better it would be able later to withstand any deteriorating in-

[1] Reprinted from *Annals of the Missouri Botanical Garden*, vol. 2, No. 3, pp. 459–498.

fluences in the distilled water, and the experiment above noted seems to bear out that idea also.

In the light of what has been said we are led to believe that the conductivity curve of Nos. 5–8 is not a pure representation of exosmosis and that the products of bacterial and fungous action and cell decomposition account for at least a part of the conductivity. While the same condition may be true of the other cultures to a certain extent, it no doubt plays a lesser, and real exosmosis a greater, part.

FIG. 4.



The conductivity curves for cultures in distilled water 20 days—after growth in full nutrient solution for 20 days. The initial temperatures of the distilled water into which the roots were placed were as follows: Nos. 21–24, 6.5° C.; Nos. 25–28, 17.2° C.; Nos. 29–32, 35° C.

In connection with the above experiment it was thought desirable to determine whether a difference in the initial temperature of the water into which the roots were placed had any immediate or subsequent effect upon the exosmosis from the roots; plants which had been grown in full nutrient solution for 20 days were used for this purpose. Four cultures were prepared with distilled water at a temperature of 6.5° C., four at 17.2° C., and four at 35.0° C., and conductivity readings were taken after exactly one-half hour, and then at various intervals for 20 days. No attempt was made to keep

the water at the initial temperatures and it therefore gradually returned to the temperature of the room. After one-half hour, when the first readings were taken, the respective temperatures were 8.9° C., 16.6° C., and 27.4° C.

The average conductivities of the water of these cultures are plotted for 20 days in fig. 4, the same units being used as in fig. 3. From these results it may be concluded that the initial differences of temperature cannot be said to have exercised much, if any, effect. The results would probably have been different had the temperatures remained at the original point during the 20 days. Wächter ('05) has considered the rôle of the temperature factor in exosmosis.

VIII. Discussion and Conclusions.

It is believed that the evidence furnished is sufficient to support the conclusion that pure distilled water *per se* is not toxic or injurious to plants, and that various other factors enter in to cause the deterioration noted when plants are placed in that medium.

Of course by qualifying the assertion to include *pure* distilled water only, we have thus eliminated the effect that may be produced by toxic substances in the distilled water, no matter from whence derived. The abundance of work that has been done on the toxicity of various substances to plant tissues would of course lead us to expect injurious effects if such substances were present in any quantity in the distilled water. With that phase of the question we are therefore not much concerned at present. With a distilled water prepared as indicated, and with a specific conductivity which is approximately 2×10^{-6}, we have a water sufficiently pure for use in the consideration of other aspects of the question, and attention is directed to these.

The evidence presented has inclined us strongly to the view that the fundamental basis of the deterioration of plants in distilled water rests upon the food relations of such plants, but that, on the other hand, an exosmosis of food materials or nutrient salts is in no way responsible for the difficulty. It is considered that the question of the food relation plays an important rôle in the incipiency of the disorder, but that this is quickly followed by factors which have been initiated as a result of the inimical food or nutrient relation.

A plant must assuredly have food in order to thrive. The more food it has stored up in its tissues, the longer it can survive in a medium devoid of it. But because of the absence of available food it

is believed that the tissues of the plant begin to become disorganized and in that condition fall a ready prey to bacterial and fungous action, which may then set in and play a very important part in the subsequent decomposition of the tissues.

While it may seem paradoxical to assert in one clause that absence of food is the fundamental basis of the injury which plants undergo in distilled water, and in the very next to say that exosmosis of nutrient salts plays no rôle, yet the results obtained have substantiated that idea. Furthermore, it is essential to consider the various other factors attendant upon these two conditions in order to arrive at the proper conclusions respecting their operation. Among such factors may be mentioned the decrease in conductivity after a short period coincident with exosmosis from normal tissues, the relation of sterilization to bacterial and fungous action, the recovery of plants under different conditions, and the numerous other questions already considered in the body of the article, all of which lend weight to the conclusions arrived at.

IX. Summary.

A brief historical review is given in this paper of the views held in regard to the cause of injury to plants in distilled water.

The methods of work are outlined.

The experimental work is given and the results discussed, especially with reference to the conclusions of other workers.

A discussion is given of the results obtained in the experimental work and the conclusions derived therefrom are stated.

Some of the results obtained from the experimental work may be summarized as follows:

(*a*) Renewing the distilled water of the cultures every 4 days was in general beneficial, as shown by increased growth of both tops and roots. The plants were also able to survive longer in the renewed than in the unrenewed distilled water, and continued growth better after being placed in a full nutrient solution.

(*b*) The period between 5 and 10 days in distilled water is a crucial one for plants; if they remain longer in this medium they are unable to recover normally or completely when subsequently placed in a full nutrient solution.

(*c*) By keeping the plants in distilled water a certain period before transferring to full nutrient solution the maturity of the plants is delayed.

(*d*) The longest period during which plants can be kept in distilled water and later recover on being placed in full nutrient solution was found to be 30–40 days. For certain dilute toxic solutions this period was much less, thus indicating that the so-called toxicity of distilled water is, if it exists at all, very slight.

(*e*) The lateral roots of "boundary cultures" were characteristically long and thread-like.

(*f*) Sterilizing the distilled water by boiling one-half hour every 4 days exercised a beneficial effect upon the growth of plants in that medium as compared with the growth of those in unsterilized distilled water.

(*g*) Greater total exosmosis was obtained in the renewed than in the unrenewed distilled water.

(*h*) Normal plants which have been grown for some time in full nutrient medium and then transferred to distilled water exhibit at first greater excretion than absorption of electrolytes. After one or two days, however, there is greater absorption than excretion and the conductivity curve declines. This condition may be maintained for a considerable period.

(*i*) The conductivity curve of the full nutrient solution in which plants were grown rapidly fell during the first 15 days or so; then it was more or less horizontal for a period, and finally began to incline after about 50 days. The growth curve was in general opposite in character to the conductivity curve.

(*j*) The conductivity of the distilled water in one series in which the roots of pea seedlings were placed was practically the same on the 10th as on the 5th day. After the 10th day it rose considerably. The growth curve showed a rise the first ten days, then a decline.

(*k*) Higher conductivity in the distilled water after 20 days was caused by plants which had not previously been in full nutrient solution than by plants grown for a time in full nutrient solution before transference to distilled water. The former cultures also failed to give the decline in conductivity characteristic of normal plants transferred from full nutrient solution to distilled water.

(*l*) Greater deterioration of the roots in distilled water occurred if the plants had not previously been in full nutrient solution than in the case of plants which had been grown for a time in the latter medium.

(*m*) Initial difference of temperature of the distilled water produced no effect on the exosmosis of electrolytes.

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PYORRHŒA ALVEOLARIS.

Preliminary Report on Treatment with Ipecac and Emetin Hydrochloride.[1]

By John S. Ruoff, Assistant Surgeon, United States Public Health Service, Fort Stanton Sanatorium for Tuberculosis.

The investigation of the curative effects of ipecac and emetin in pyorrhœa alveolaris was instituted by direction of the Surgeon General, United States Public Health Service, the conditions at this station (Fort Stanton) being especially suitable for the work. The patients are under the immediate surveillance of the officer in charge and are at all times accessible for the administration of treatment. Every encouragement was offered for a thorough trial. The coöperation of the patient was further enlisted by pointing out the possible effects of pyorrhœa alveolaris on tuberculosis and the good that might result from the cure of existing pyorrhœa. The work has been under way for nine months. It is still being pursued.

In setting forth the results obtained in the treatment of pyorrhœa alveolaris at the Fort Stanton Sanatorium, a few words as to the class and character of patients treated will not be out of place.

The patients at this sanatorium consist of the beneficiaries of the

[1] Reprinted from *Public Health Reports*, January, 1916, p. 108.

United States Public Health Service, made up in this instance chiefly of seamen and officers of merchant vessels. A large percentage of these men have never taken proper care of their teeth; thus out of 78 cases treated 51 had always neglected their teeth. The care bestowed by the remainder is doubtful. Pyorrhœa, as stated by the leading workers with the disease to-day, is practically universal and one would naturally expect to find a large percentage of far-advanced cases among this class of men. Of the 78 treated, 34 (43.6 per cent.) were far-advanced cases of pyorrhœa. All of these patients have tuberculosis in some stage, but mostly far advanced.

Knowing that the tuberculous patient is subject to disturbances of the alimentary tract, and knowing too that emetin tends to cause nausea, vomiting, and diarrhœa, it will be correctly surmised that the investigators have had more than their share of these symptoms to contend with. Also, they have had to content themselves with the minimum number of injections in each case for fear of upsetting the stomach and causing the patient to become dissatisfied and discontinue the treatment altogether. In a large number of cases they have had to use emetin hypodermatically until the endameba were no longer demonstrable, and then to depend upon the local use of a mouth wash of fluidextract of ipecac in an effort to maintain the condition.

Knowing the tendency of the tuberculous subject to become hypochondriacal, neurasthenic, nervous, his tendency to complain of the least discomfort, and knowing, too, the discomfort and pain, at times extreme, caused by the local reaction of emetin given hypodermatically, one will surmise, and correctly, that the investigators have had to contend with many complaints of painful arms and have had to discontinue the hypodermatic treatment for that reason in many of their cases. It may also be added here that the number of cases treated would have been much larger had it not been for the local discomfort and other deleterious effects caused by emetin, these effects causing the treatment to be contraindicated in some and refused by a large number of subjects in whom it was indicated.

Recent writers state that about 98 per cent. of all persons will show the endameba-buccalis. Of 190 examined here, 187 showed the endameba. Our cases were chosen at random among the patients. Practically all of them seemed to have a pyorrhœal tendency, although of the 78 treated, 14 had no clinical symptoms of pyorrhœa, while the remainder, 64, had one or more of the clinical symptoms: viz.,

pockets, pus, loose teeth, receding gums, and bleeding gums. Of these, the last-named symptom was the most frequently found, occurring in 51 of the 64 cases. It may be stated that this symptom of bleeding gums was the one most frequently affected by the emetin and ipecac, and always the first to disappear.

The investigators followed in a general way the plan of treatment set forth by Bass and Johns in their book, " Pyorrhœa Alveola-Dentalis." Each patient was given an initial examination, his history being taken at the same time to determine as nearly as possible the date of onset, amount of care taken of the teeth, the use of tobacco, the condition of the digestive apparatus, and the presence or absence of bleeding gums. He was then sent to the dentist and a careful examination of the mouth made to determine the condition of the teeth and gums. The teeth were then scaled, old roots and hopeless teeth were extracted, and the mouth was put in as good condition as possible, some of the actual operative work being done by the writer. No other operative procedures were attempted, and no routine treatment of the teeth and gums was carried out other than by the brush in the hands of the patient. He was next sent to the laboratory, where a microscopical examination was made for endameba.

For the convenience of study, and ease in tabulating and comparing results, the cases were divided into classes, as shown below.

At the time of scaling by the dentist each patient was given a supply of fluidextract of ipecac to use locally. The first two classes to be treated were directed to use two or three drops on the brush. The investigators also used a tooth powder modified by mixing with the stock 5 grams of powdered ipecac to 95 grams of the powder, but this was later discontinued and all were directed to use 10 drops of fluidextract of ipecac in one-fourth to one-half glass of water as a mouth wash after cleaning the teeth morning and night.

CLASS I.

This consisted of 20 men, of whom 2 (squad A) had apparently healthy mouths; 7 (squad B) had receding or bleeding gums or both; while 11 had gross lesions of pyorrhœa. All received three ½-grain (0.03 gram) doses of emetin on consecutive days and were examined for endamebæ on the fourth day, and all found positive. This treatment was repeated on the three following days, and upon re-examination 11 were found negative, 7 were still positive, and 2 were discontinued on account of nausea, vomiting, and loss of appetite. These

7 were then given three ¾-gram (0.045 gram) doses of emetin on consecutive days, and upon re-examination 6 were negative and 1 still showed endamebæ. This one case was given three more ¾-grain (0.045 gram) doses of emetin on the next three days and was finally negative after the twelfth dose, having received six doses of one-half grain (0.03 gram) each and six doses of three-fourths grain (0.045 gram) each, covering a period of 12 days.

Subsequent History of Class 1.—All continued to use the fluid-extract of ipecac locally, but in spite of this every member of class 1 showed the endamebæ upon re-examination four weeks later. The physical condition of the gums and teeth in squad A was unchanged; 4 of squad B remained the same, 2 were moderately improved, and the results were doubtful in 1; of squad C, 8 remained the same, 1 was slightly improved, and 2 were greatly improved.

At the time of writing, three and one-half months later, the condition of these mouths has not changed.

CLASS 2.

This consisted of 12 men, of whom 4 (squad A) had healthy mouths; 8 (squad B) had receding or bleeding gums, or both; there were no far-advanced cases of pyorrhœa in this class. All received three ½-grain (0.03 gram) doses of emetin on consecutive days and were examined on the fourth day. Of the 12 men, 6 were negative after three doses of one-half grain (0.03 gram) each; 1 discontinued treatment on account of rise of temperature; the remaining 5 received three more ½-grain (0.03 gram) doses on the next three days; and all were found negative after the sixth dose.

Subsequent History of Class 2.—All continued the use of fluid-extract of ipecac locally, but all showed the endamebæ three weeks later. The physical condition of the gums and teeth in squad A and 5 of squad B remained the same, while 3 of the latter were slightly improved.

At the time of writing, three months later, the physical condition of these mouths is unchanged.

CLASS 3.

This class consisted of 13 men, of whom 1 had a healthy mouth, 8 (squad B) had receding or bleeding gums or both, and 4 had gross lesions of pyorrhœa. None were negative after three doses of one-half grain (0.03 gram) each, but 6 were negative after six doses of

one-half grain (0.03 gram) each; the remaining 6 were still positive, but were discontinued on account of various disagreeable symptoms.

Subsequent History of Class 3.—All continued the local use of fluidextract of ipecac, but 11 of the 12 men showed the endamebæ two weeks later. The physical condition of the gums and teeth in the 1 healthy mouth remained unchanged, 4 of squad B were slightly improved, and 3 were moderately improved. In squad C, 2 were slightly improved, while 2 remained the same.

At the time of writing, nearly three months later, the physical condition of these mouths is unchanged.

CLASS 4.

This class consisted of 5 men, all with unusually good teeth, but with incipient pyorrhœa. No emetin was given hypodermatically. These men were all given a mouth wash of diluted hydrogen peroxide and fluidextract of ipecac. After brushing the teeth the mouth was rinsed with hydrogen peroxide, then with fluidextract of ipecac, 10 drops in one-fourth glass of water. This was kept up twice daily for two months, at the end of which time they all still showed the endameba and no improvement in the physical appearance of the gums and teeth.

Our experience is thus at variance with the results recorded by Bass and Johns in work with a similar class of cases.

CLASS 5.

This consisted of 12 men, of whom 1 (squad A) had a healthy mouth, 6 (squad B) had either receding or bleeding gums or both, and 5 showed gross pyorrhœal lesions. Four were negative after three doses of one-half grain (0.03 gram) each, 1 discontinued treatment on account of rise of temperature. Seven men received six doses of one-half grain (0.03 gram) each, but only 2 were rendered negative; the remaining 5 discontinued treatment on account of various disagreeable symptoms.

Subsequent History of Class 5.—Eleven of the 12 men showed the endameba four weeks later in spite of using fluidextract of ipecac as a mouth wash. The physical condition of the gums and teeth in the 1 healthy mouth remained the same, 2 of squad B remained unchanged, and 4 were slightly improved. In squad C, 1 was slightly improved and 4 were moderately improved.

At the time of writing, two and one-half months later, the condition of all these mouths is the same.

CLASS 6.

This class consisted of 16 men, of whom 1 (squad A) had a healthy mouth, 5 (squad B) had receding or bleeding gums or both, and 10 (squad C) had gross lesions of pyorrhœa. All received six ½-grain (0.03 gram) doses of emetin on consecutive days before being re-examined. Twelve were negative after the sixth dose, 1 discontinued treatment on account of local reaction, 3 were still positive but were discontinued on account of the exhaustion of our supply of emetin.

Special Technic in Observations on Local Reaction.—This class was subdivided into four smaller groups of four men each. Group A received hypodermatic injections of emetin dissolved in 2 c.c. of water injected into the arm. Group B received emetin dissolved in 4 c.c. of water injected into the arm. Group C received emetin dissolved in 2 c.c. of water injected into the buttocks. Group D received emetin dissolved in 2 c.c. of normal saline solution injected into the arm. No marked difference in the amount of local reaction was noticed.

Subsequent History of Class 6.—Of the 12 men that were negative after the sixth dose of emetin, 10 were re-examined four months later and all found positive, although all used fluidextract of ipecac as a mouth wash twice daily. The physical condition of the gums and teeth in the 1 healthy mouth and in 2 of squad B and in 4 of squad C remained the same. Two of squad B and 5 of squad C were slightly improved. The results were doubtful in 1 man in squad B, while 1 of squad C became worse.

At the time of writing, two months later, the physical condition of the gums and teeth remains unchanged.

Status of Pyorrhœa Treatment in the Literature.

Ernest Sturridge, D.D.S., London,[2] prefers the treatment of pyorrhœa by ionization with zinc ions, and says " after treatment by ionization alone with zinc chloride " he found in every instance that amebæ were not present upon re-examination. He recommends in addition careful cleansing and instrumentation and the application of a weak solution of iodine in bad cases, as advocated by Dr. Barrett.

Barton Lisle Wright and Paul Gardiner White, United States

[2] Ernest Sturridge, D.D.S., *Dental Cosmos*, July, 1915.

Navy,[3] give deep muscular injections of mercuric succinamid and claim good results.

F. E. Stewart, M.D., Phar.D., Philadelphia,[4] recommends thorough removal of all tartar and dead and infected pulps, the filling of root canals, the use of fluidextract of ipecac or emetin as a local application to the gums and teeth in tooth washes, the employment of emetin to destroy endamebæ, and the injection of bacterin, either a stock bacterin or an autogenous vaccine.

Arthur H. Merritt, D.D.S., New York,[5] places no confidence in either emetin or vaccines when he says that "no drug or vaccine ever will of itself cure the disease." He believes pyorrhœa to be a preventable disease, and a curable disease if not too long neglected. His treatment consists in a "careful curettage of each pyorrhœal pocket, the removal of calcareous deposits and necrotic tissue, the correction of occlusion on weakened teeth, the stimulation and massage of the gums, and the maintenance of a high standard of mouth hygiene."

T. Sidney Smith, Palo Alto, Cal.,[6] has confidence in proper surgical treatment of pyorrhœa, and says, "Peridontal diseases are not cured until the pyorrhœal pockets have been entirely obliterated," and "that such healing does not depend on either the absence or presence of endamebæ, but entirely on the character of the tissues and the thoroughness of the surgery."

Summary of Results.

Of 190 cases examined 187 showed endameba. Of the 187, 78 have been treated for pyorrhœa. Of the 78 treated, none lost their endamebæ permanently. The condition of the gums and teeth was greatly improved in 3 cases, moderately improved in 9 cases, slightly improved in 22 cases, while 41 cases remained the same; the results were doubtful in 2 cases and 1 case became worse. Practically all that were found negative for endamebæ at the conclusion of the injections were found positive for endamebæ from two weeks to four months later, in spite of using a solution of ipecac as a mouth wash.

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[3] Barton Lisle Wright, M.D., and Paul Gardiner White, M.D., *Dental Cosmos*, July, 1915.

[4] F. E. Stewart, M.D., Phar.D., *New York Medical Journal*, Aug. 7, 1915.

[5] Arthur H. Merritt, D.D.S., *Ibid.*, Aug. 7, 1915.

[6] T. Sidney Smith, D.D.S., *Journal A. M. A.*, May 8, 1915.

Conclusion.

Emetin is an ambecide, but alone will not cure pyorrhœa alveolaris.

Outline of Future Work.

Less confidence will hereafter be placed in the properties of emetin or other preparations of ipecac, although it is not denied that the drug possesses ambecidal properties. It appears necessary to revert to a degree at least to those painstaking and tedious operative procedures, the efficacy of which has long been known to dental surgeons. Just how much assistance is to be expected from the ipecac preparations used in conjunction with operative measures is a question upon which further studies may be expected to throw some light.

Acknowledgments.

Surg. F. C. Smith, in charge of the station, has made valuable suggestions in the preparation of this article. Acting Asst. Surg. H. P. Reid has done most of the microscopic work, and the station dentist, Dr. C. R. Irby, has performed most of the necessary operative work.

THE IMPORTANCE OF DRUG PLANT CULTIVATION IN THE UNITED STATES.[1]

By Heber W. Youngken, Ph.D., Adjunct Professor of Botany and Pharmacognosy, Medico-Chirurgical College.

The present European conflict has done much toward arousing the spirit of initiative on the part of Americans, not only in investigating an economic means for the manufacture of dyestuffs and various synthetic chemicals previously alone carried on by the Germans, but also in stimulating research along the important line of drug plant cultivation. More than one-half of our most important crude drugs and their products come from foreign sources. Before the war these were in regular commerce, and efforts at cultivation, mostly experimental, were confined to the U. S. Department of Agriculture, a few interested teachers and several pharmaceutical houses. Now that importation of drug plants has practically ceased, their cultivation in this country is necessary. Indigenous drug plants, too,

[1] Reprinted from the *Mulford Digest*, vol. iii, p. 86.

which at one time grew abundantly in our forests and meadows, have been gradually disappearing with the spread of population and agriculture and depredations of unintelligent drug collectors.

The mere raising of medicinal plants to supply the quantitative demand for crude drugs, however, is not the only problem which confronts the manufacturing pharmacist. With the demand for accurately standardized medicinal products of known potency and quality the need of controlling drug plants in regard to botanical species, method of selection of seed, pollinization, cultivation, harvesting, curing, etc., is apparent.

To attempt to grow very many species of drug plants in any one locality is well-nigh impossible, since it has been shown the necessary environments differ widely for diverse types of vegetation. The first step, therefore, should be taken with a view toward developing conditions for the various species to be grown approaching those under which they are found in nature. Xerophytes, or desert plants, for example, would not thrive in soil, climate or other surroundings adapted solely to mesophytes or middle plants, nor would certain genera of the same family of either of these groups, such as Digitalis and Strophanthus of the Scrophulariaceæ family of mesophytes grow equally well under identical conditions. Hence the nature of the soil, climate and proximity of other plants must be studied for each plant selected for cultivation in any given section.

It is also desirable to inquire into the best ways of propagating the plants. Occasionally this is by means of seeds, as in digitalis, belladonna, stramonium, hyoscyamus and all annuals and biennials; at other times it is by the propagation of prostrate stems, as in many of the labiatæ or mint family; or again by the propagation of rhizomes, as in ginger or hydrastis. After the seeds and cuttings are planted and transplanted (if necessary) the next step is the proper care in rearing the plants to maturity or to that stage when it is desirable to harvest the drug. While the plants are in flower, efforts should be made toward hybridization or crossing of varieties or species, with an aim toward increasing the active principle content of the resultant hybrids. It is known that the cultivation of cinchona has increased the alkaloidal yield 5 to 6 per cent., while hybridization of different species and varieties of cinchona has increased the alkaloidal content of the product hybrids as much as 11 to 12 per cent. above the quantity found in either of the parents crossed. Careful selection of strains found among the hybrids of the second generation

yielding a high active principle content might be found a profitable undertaking.

In addition to harvesting at the proper time and correct methods of drying, some drugs, such as vanilla, coca, digitalis, belladonna, hyoscyamus, etc., undergo fermentation. This is called the curing process. The biological factors in this process must be carefully investigated in order to determine at what time and under what conditions the drug acquires its greatest value.

The manufacturing pharmaceutical houses of this country are in the best position at the present time to cope with the problems of drug plant cultivation, because they have the necessary facilities as well as the coöperation of trained pharmacognocists, chemists, pharmacists and biologists. The subject is in its infancy and much experimental work, especially in the matter of selection, must be carried out before the problems at hand are adequately solved.

The H. K. Mulford Company has been cultivating drugs on an extensive scale for the past five years. Their efforts so far have been in the line of securing a sufficient supply of reliable digitalis, belladonna, hyoscyamus, hydrastis and cannabis, the cultivation, collection and curing of each drug receiving careful consideration.

The cultivation of the drug plants from which the physicians' medicines are prepared marks another step toward converting medicine into an exact science. Standardization of drugs by methods of control and testing, operating from the time the seed of the plant is placed in the ground, not neglecting the selection of the seed itself, until the medicinal product is ready for the physicians' use, thus insuring a product of known and invariable potency, will alone make possible accurate observation of the effects of such drugs when used as weapons with which to fight disease.

CORRESPONDENCE.

Increase of Prices for Drugs and Chemicals.

The February meeting of the City of Washington Branch of the American Pharmaceutical Association was held at the National College of Pharmacy, Washington, Wednesday, February 23, 1916.

The subject of the evening was a talk on the increase of prices for drugs and chemicals, the cause and effects, together with the future

prospects, by Mr. Wymond H. Bradbury, assisted by Mr. M. I. Wilbert.

Mr. Bradbury discussed the subject very fully and brought out many points of interest, and clearly showed that the first rise in prices of drugs and chemicals was due directly to the disturbance in Europe and the general opinion that the war would last but a year, the result being that large manufacturers, at once, when hostilities broke out, purchased their supplies for a year; at the expiration of this time, when their stocks were running low, they went again into the market, heavily buying everything obtainable, with the effect that prices again soared, thus marking two separate and distinct, decided advances.

He further showed that by reason of embargoes all drugs grown in the restricted districts were not obtainable; likewise this is true of chemicals made abroad, many of which have never been made in America. Imports are difficult, high insurance rates on cargoes, and no available ships, with exports practically cut off and large demands from abroad, have assisted in the advance of domestic-made goods.

Many commodities are controlled by second hands who are holding for large increases. The potassium situation is a serious one and may result in the replacing of all potassium salts with sodium. The large increase in bromides is due principally to the increased demand for bromine in the manufacture of gas bombs. Many chemicals, as well as foreign-grown drugs, are now unobtainable or the price is prohibitive. The increases in prices of sulphuric acid, soda ash, and many other products have caused material increases in prices of glassware and other manufactured products. He pointed out that 10 per cent. of the glycerin made in America was used by the duPont Powder Works. At the present time American manufacturers are refusing to sell the product for dynamite manufacture. Zinc and copper and their salts have increased, owing to their use in war materials.

The probable future will be that the abnormal prices will drop, owing to increased growing and manufacturing by the countries at war, but no such low prices as prevailed before the war can be expected, probably not for years. Many products, especially trade-marked goods, will never return to their former basis; the general cut in price for these articles by the retail trade has shown the manufacturers that they can increase their price and still the public will obtain the goods at less than the manufacturer's advertised price, owing to the cut-rate evil. He also pointed out the possibility of the placing of export duties on many products by foreign countries

and also government control of many drugs, thereby maintaining higher prices than before the war. This is shown by the action of Mexico with reference to vanilla, and Great Britain with sandal and buchu.

He maintained that, while the retail trade had been affected, it was not as seriously affected as the manufacturer and wholesaler.

The paper was discussed at some length by the members present, and the attendance at this meeting was larger than usual. It was pointed out by Mr. Wilbert that we in America were much better off than many foreign countries. Many articles are unobtainable or at prices many times higher than in this country. He also showed that many agents in this country of German houses were now making many of the products, and while, in many cases, they are obtaining advanced prices, they at the same time are keeping the market for the German manufacturers, so that when the war ends they will not have to reëstablish their business in this country. He further pointed out that much more manufacturing would now be carried on if the manufacturers were assured that they would receive some kind of protection. Politics here is playing an important part. The condition now existing has resulted in the markets being flooded with all kinds of fake goods, principally by peddlers, all of whom have been working all kinds of schemes, so that it is dangerous to purchase any products from any but legitimate dealers unless same and every lot and package are carefully tested.

S. L. Hilton,
Secretary.

CULTIVATION OF MEDICINAL PLANTS.[1]

Trial Cultivation in Usumbwa.

In a report by H. L. Hammerstein[2] on part of the trial cultivations hitherto carried out in the Tabora district, Usumbwa territory, German East Africa, we likewise find something interesting for our special domain, *e.g.*, that betel pepper (*Piper Betle*, L.) prospers fairly well in soil to which lime has been added. It climbs on *Ficus* species, but is very sensitive as regards intense insolation.

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[1] Semi-annual Report on Essential Oils, Synthetic Perfumes, etc., by Schimmel & Co., October, 1914, to April, 1915.

[2] *Der Pflanzer*, 10 (1914), 224.

The *Juniperus procera*[3] trees (Usambara cedar), now 2 years old, are of vigorous growth and have attained a height of 1 m. The prolonged drought in that region has not had any influence on their development. All *Eucalyptus* species have much to suffer from termites. Two-year-old specimens of *Eucalyptus robusta* and *rudis* have now attained a height of up to 4 m., and the diameter of the trunks comes to about 10 cm. Citronella grass prospers; the propagation is effected by suckers. *Andropogon citratus* is indicated as mother plant, so that there seems to be a confusion with lemongrass.

Grafted young Italian lemon trees, received from Amani in December, blossomed after barely 3 years, and some formed fruit. Plants derived from seeds are still far behindhand. Limetta trees grow rather slowly. Genuine, grafted Italian orange trees flourish best. Seedlings grow very slowly at first; the seeds often take 5 to 6 months to germinate. Mandarine trees get on slowly and are highly sensitive as regards burning sunshine. The nutmeg trees died. Ginger grows slowly; cardamoms flourish better. Caraway and anise do not form seed; coriander grows well. Many other plants of the spice and kitchen herb line flourish well or in any case satisfactorily, *f.i.* balm (melissa), chervil, fennel, dill, marjoram, thyme, estragon, satureja, and parsley.

Cultivation of Medicinal Plants.

From E. Senft's[4] communications on trial cultivation of medicinal plants at Korneuburg in 1913, we gather some data of general interest concerning aromatic plants. From the group of vegetal parasites, *Puccinia Menthæ* ought to be mentioned. Japanese peppermint suffered most from it. Leaf-lice (*Aphis Angelicæ* and *Ligustici*) caused damage in angelica and lovage fields.

Larvæ of beetles (*Agriotes*) and multipeds (*Blanjulus*) damaged angelica roots. In autumn, 1912, angelica seed was sown on a small piece of land; during the spring following the plants developed fairly well, but later on large gaps appeared, owing to the damage done by multipeds. Many rootlets were much eaten; the main roots, sometimes pierced. Further reports are made on the plantations of Roman

[3] The wood of *Juniperus procera* is used in the manufacture of lead-pencils.—*Comp. Report*, October, 1911, 106.

[4] *Zeitschr. f. d. landwirtsch. Versuchsw. in Österreich*, 1914, Part 3/4. *Mitteilungen des Komitees zur staatlichen Förderung der Kultur von Arzneipflanzen in Österreich*, Nr. 17. From a reprint kindly sent us.

chamomiles, wormwood, estragon, spoonwort, lavender, lovage, balm (melissa), peppermint, *Mentha canadensis* (Japanese peppermint), spearmint (*Mentha viridis*), *Mentha* from Admont (Styria), from Bohemia, from Moravia, winter marjoram, garden rue, parsley, sage, *Salvia Sclarea,* tansy, thyme, hyssop and valerian.

In addition to the simple Roman chamomiles (*Anthemis nobilis*), there was another variety of cultivation, *Anthemis nobilis* var. *β-floscula,* Pers. (*Anthemis aurea,* DC.), which distinguishes itself by having lost the marginal flowerets completely. This variety is said to have a specially strong aromatic odor.

Manuring experiments gave satisfactory results with wormwood. The yield amounted to 98.6 kilos of fresh and 24.2 kilos of dried herb per square m. for a manured piece of land, and 63.1 kilos and 16.15 kilos, respectively, for unmanured soil. Wormwood-growing in Austria pays only where ground and labor are cheap. Wormwood does not require any special care, aside from keeping the field free from weeds. In consequence, waste grounds, slopes, etc., are best adapted for it, where it can spread by itself. Wormwood, which has again run wild, is sometimes preferred to the cultivated plant.

From a surface of only 8 square m. not less than 47.9 kilos of fresh estragon herb were collected.

Spoonwort was sown on April 30. On October 8 the plants were put on a piece of land freshly prepared. They stood the winter very well and sent out flower stalks already at the end of February; at the beginning of May the field was in full bloom. Cutting caused not only fresh leaves to form, but likewise fresh flower stalks.

Senft thinks a successful cultivation of lavender impossible at Korneuburg, as lavender requires protection against wind.

It is worth mentioning that lovage was the only plant which did not suffer from canker-worms.

On unmanured soil, 8.6 kilos of spearmint were obtained per 100 square m., whereas a manured piece of land yielded 15.87 kilos. Spearmint leaves are crisped and rather short in proportion. These crisped leaves extend remarkably, however, when the plant forms flowers; the crisped border then disappears and the aspect of the plant changes altogether.

The peppermint plants got through the winter rather badly. They remained low and looked sickly; some turned reddish at first, then brown, and died. The cause of this disease has not been found so far.

Mentha viridis seems to be very resistant against *Puccinia;* the

disease was neither noticed at Korneuburg nor elsewhere. A plantation of a peppermint variety, cultivated in the marsh farm at Admont (Styria), was almost entirely destroyed by parasites.

In order to obtain parsley roots, it seems to be advisable to cut down the flower stalks, so that the roots can get stronger.

Hyssop and garden rue yielded less on a manured piece of land than on unmanured ground.

Sage frequently suffered from the winds generally prevailing at Korneuburg. Moreover, sage must never be left over 3 years in the same place, as the yield generally diminishes considerably already in the fourth year. Like rue, sage is unfavorably influenced by stable manure.

A plantation of thyme had developed very well and not suffered at all from the drought early in 1913.

A plantation of valerian was almost entirely destroyed by canker-worms.

As far back as 1904, B. Pater [5] tried to cultivate medicinal plants at Klausenburg. He now reports on spearmint and peppermint. Spearmint was cut first at the end of June, then again at the end of September, and a third time between October 17 and 22. In order to find out what effect the third cut might have, he left half the field untouched; it turned out the next year that the third cut had not had any influence on the plants getting through the winter. He recommends as the best remedy against *Puccinia Menthæ* to cut the plants earlier and not to wait until the flowers appear. It is true, one generally imagines that the plant is richest in oil when flowering, but it must be taken into consideration that the leaves attacked by *Puccinia* are without any value. *Puccinia* seems to spread from the soil, for the bottom leaves show the disease first, and then it spreads upwards.

Pater further describes the properties of Hungarian spearmint oil, on which we have reported before now.[6] Experiments of perfuming soap with spearmint oil gave very favorable results. An antiseptic soap of pleasant odor was thus obtained, which made the skin soft and smooth.

Pater reports fully on his experiments with peppermint. He cultivated plants which came from Rev. Josef Agnelli's plantation at Csári

[5] *Die Heilpflanzenversuchsanstalt der landwirtschaftlichen Akademie in Kolozsvar,* Part 1; Kolozsvar, 1914.

[6] *Comp. Report,* April, 1912, 118.

and which he calls *Mentha piperita* var. *Agnelliana.* The herb was dried naturally as well as artificially, this in a heatable hop-oast. The naturally-dried peppermint contained 0.7024 p.c., that dried artificially, 0.8844 p.c. of oil. Peppermint planted in spring 1908 was already in 1912 very weak and degenerated, so that it could hardly be used. The soil was poor and exhausted from the outset, which accounts perhaps for the failure of the experiment.

The properties of Hungarian peppermint oil,[7] as well as of *Oleum Menthæ aquaticæ Hung.*,[8] were described by us already three years ago.

Experiments with Mitcham and Japanese peppermint are also being made. About 80,000 slips of Mitcham peppermint are required for 1 hectare of land.

In 1904, Pater planted pieces of rhizomes, taken from calamus plants from a pond close by, on a bed which could easily be watered. In October, 1906, the calamus was well developed. The bed had, it is true, frequently been weeded, hoed and manured. The result was satisfactory.

The Cultivation of Violets in Southern France.

In an article published by a French horticultural journal,[9] we find an exact description of the cultivation of violets in southern France, as well as statistics of the export of violets from Hyères. The cultivation was begun there about 30 years ago; it has developed to such an extent that in winter more than 500 parcels of 3 kilos each are sent off daily. There are 500 to 600 women employed in the gathering. Of late years, Vence, a village in the Maritime Alps (*arrondissement* Grasse), seriously competes with Hyères. For half a century, flowers for the perfumery industry had been grown at Vence, but on account of the low prices offered by the manufacturers, a start was made to cultivate violets for the export of the flowers, with remarkable success. The varieties mostly planted are "Victoria" and "Princesse-de-Galles."

At Hyères, the violets are still frequently grown on open fields, but of late the growers have begun to cover the plantations slightly against frost, which causes the flowers to appear sooner.

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[7] *Comp. Report,* April, 1911, 91.

[8] *Ibid.,* April, 1912, 132.

[9] *Bull. Soc. Hort. Nice,* 17 (1913), 373; *Bull. Sciences pharmacol.,* 21 (1914), 234.

Directions How to Collect and Preserve Plants in Foreign Countries.

For those desiring to send home plants from distant regions or to collect plants in foreign countries for scientific purposes, an article in the well-known "Kew Garden Bulletin of Miscellaneous Information" gives useful, adequate directions.[10] If it is a question of collecting new material for gardeners, seeds are preferable to living plants or cuttings. Some plants, however, such as orchids, many tuberous plants (*Aroideæ*) and some *Zingiberaceæ*, cannot, or only with difficulty, be raised from seeds. The seeds must be ripe and dry and are best forwarded in small canvas bags. Hermetically sealed tins and bottles are not to be recommended, as seeds keep better if change of air is possible. Bulbs and rhizomes should only be collected after the period of vegetation is over and must be kept dry for some days, until the leaves have faded. They are best forwarded in wooden boxes and packed in wood shavings, paper, or some other dry, light material. Straw and hay cannot be recommended, as they rot easily. If the rhizomes are weakly and thin, they are best packed in a light, slightly moistened material, such as cocoa-nut fibres, peaty soil, sawdust or wood shavings. Rhizomes and seeds of aquatic plants and ferns are best sent in damp moss. Cuttings, *e.g.*, of *Pelargonium* species, should be packed in oiled silk and then placed in tins or wooden boxes. Many plants, such as pelargoniums, which are very resistant against drought, may be put into wooden boxes, the roots being tightly packed in moss, wood shavings, banana leaves, etc. Seeds for museums may be sent dry without any special precautions. If damage through insects is to be feared, carbon disulphide must be poured over the seeds, or naphthalene added before packing in tin boxes. Cones of conifers, which open when dry, must be tied up with string, so that they cannot lose seeds on the way. Soft fruits are placed in bottles with alcohol, rum, salt water or a 5 p.c. formaldehyde solution. Fruits and succulent plants may likewise be kept in alcohol or formaldehyde for several hours and then wrapped up in cotton wool, impregnated with said preservatives.

Another part of the article refers to the collection of material for herbariums. As a general rule, only complete material ought to be taken, *i.e.*, plants with flowers and fruits. When drying, the universally known rule is to be followed to press little at the beginning and

[10] *Kew Bull.*, 1914, 97.

a little harder later on, but to avoid too much pressing altogether. It is of great importance sometimes for later investigation to have some flowers preserved in alcohol, formaldehyde, or salt water.

A method recommended by Schweinfurth is complicated, it is true, but affords excellent results. The plants are placed between paper, as usual, and then put in layers into tin boxes, exactly described in the original, after alcohol has been poured over the whole. The tin boxes are then soldered, and the plants, which thus keep for a fairly long time, may be dried later on, when there is a favorable opportunity. This method has a very great advantage during rainy periods. It is self-evident that the material must be carefully labelled.

The World's Production of Essential Oils.

J. C. Umney [11] discusses the world's production of essential oils in a very exhaustive article. He indicates, for almost every country, which plants are grown and collected for the manufacture of volatile oils or might come into consideration for the purpose. It seems that he bases his inference on indications regarding the smell of the various plants, as are found here and there in books, so that many of his suggestions will presumably have no practical value. The article further contains statistics of the production and export of the most important essential oils.

Occurrence of Fragrant Plants in Hawaii.

In the same periodical, we find an article [12] on the occurrence in Hawaii of a plant smelling like violets and which is called there either "*Pakalang*" or "Chinese violet." Holmes presumes that this plant is *Pergularia fragrantissima*, an *Asclepiadacea*.[13] The aromatic principle of the flowers can be extracted by way of "enfleurage." In addition, a plant referred to as "*Mulang*" is cultivated, which most likely is identical with the champaca shrub (*Michelia Champaca*). *Acacia Farnesiana* likewise occurs in Hawaii under the name of "*Klu*." E. V. Wilcox [14] points out the possibility of using this plant for the manufacture of scents.

[11] *Perfum. Record*, 5 (1914), 164.

[12] *Ibid.*, 5 (1914), 130.

[13] The *Index Kewensis* does not mention this species, but *P. odoratissima*, Sm., probably indigenous in Farther India and which is largely cultivated in East Asia and East India on account of its sweet smelling flowers.

[14] *Americ. Perfumer*, 9 (1914), 75.

Peppermint Oils.

W. Himmelbaur [15] reports on deterioration and subsequent disease of *Mentha* plantations. It was a question of slips of *Mentha piperita* (L. *ex parte*) Huds. var. *officinale,* Sole, which were grown in a long and narrow border in an experimental nursery in Prague. The location was unfavorable, inasmuch as on one side it was only 1.5 m. distant from a high wall, and was shaded on the other side by a high tree. Moreover, the whole plantation was quite close to inhabited buildings. Another cultivation experiment was carried out in Korneuburg, where *Mentha arvensis* f. *piperascens,* Mal. (= *canadensis* f. *piperascens,* Briq.) had been planted. The plot of ground was quite unshaded, but in close proximity to some gas works. Moreover, the situation in general was rather dry and exposed to the winds. In the beginning of August a weakening of the growth made itself felt in consequence of these unfavorable conditions. In Prague, damage through smoke first, and later an attack of *Puccinia Menthæ,* the well-known fungus disease, were noticeable; in Korneuburg, however, the attack of *Puccinia Menthæ* set in first, and damage by smoke later on. Himmelbaur describes the progress of the disease with many illustrations. As compared with healthy plants it was noticed that the leaves showed little drops of a yellow substance, and many crystals. The former consisted of fatty oil, the crystals presumably of the glucoside hesperidin contained chiefly in the *Rutaceæ.* Under normal conditions these two bodies do not occur in *Mentha* in such abundant quantities.

The chief damage to be noticed was the reduction in the activity of the chlorophyll apparatus. As a further noticeable symptom of the deep-seated disturbance, the superabundance of bodies such as hesperidin is to be mentioned. Hesperidin must be looked upon as a vegetable dross in the process of metabolism, as it is never taken up again. Simultaneously all protective bodies against fungi are affected, so that an attack of fungi may easily take place or that the resisting power against damage by smoke is reduced. Quickly passing smoke does not hurt healthy plants.

As the author correctly observes, the peppermint plant is rather particular as regards location and condition of soil. It requires a moderately moist and at the same time light and sunny situation, protected from wind.

[15] *Zeitschr. f. d. landwirtsch. Versuchswesen in Österreich,* 1914, No. 3/4.

A. Wöhlk [16] reports on comparative examinations of some peppermint oils of commerce along with control tests of the ordinary menthol determination. As the results of his experiments, as admitted by himself, do not contribute anything new to the chemistry of peppermint oil, we need only mention that, according to Wöhlk, peppermint oil may be rectified *in vacuo* without material loss, but that this process offers no advantage over ordinary distillation by steam.

The indifferent results obtained occasionally in the determination of ester as well as of total menthol in peppermint oil are perhaps due, according to H. W. Redfield,[17] to insufficient cooling when boiling the oil with acetic acid anhydride or with alcoholic potash lye, whereby possibly some of the ester may escape through the condenser and so become lost for determination purposes. In order to arrive at a definite conclusion, Redfield made some comparative tests, using different reflux condensers for the experiment in question. He used an Allihn, a Chamot-Soxhlet and a Fritz Friedrichs condenser. The results with the two last-named condensers were identical, whereas the Allihn apparatus was evidently insufficiently cooled, for the percentage of total menthol was 4.87 p.c. below the values ascertained by means of the other instruments; with ester menthol the difference amounted only to 0.33 p.c.

Peppermint Oil, Japanese.

The Japanese Parliament [18] has had to deal with a bill which, if not actually a monopoly, amounted as a matter of fact to little less than the placing of peppermint business under effective state control The proposed bill in its main features runs as follows:

Persons occupied in the cultivation, manufacture and sale of peppermint are to form coöperative production societies, in accordance with the terms of the act on coöperative production societies.

All persons who have not joined any of these coöperative production societies shall be prohibited from taking part in the cultivation, manufacture, or sale of peppermint.

If the peppermint coöperative production societies contemplate the export of peppermint, they shall be obliged to join in unions for their respective districts, and to establish a central union in Tokyo.

[16] *Berichte d. deutsch. pharm. Ges.*, **24** (1914), 292.
[17] *Journ. Ind. Eng. Chemistry*, **6** (1914), 401.
[18] *Nachr. f. Hand., Ind. u. Landw.*, 1914, No. 51, p. 5.

Evidently the object aimed at with this act is to create a central body comprising all domestic peppermint producers and dealers, so as to enable them to make a firm stand against the peppermint exporters. In this manner it is hoped to prevent the latter, comprising only about 3 to 4 firms, from forming a ring with a view to regulating purchase prices, a combine against which the farmers would be powerless.

The bill was brought in but a few days before the close of the session. Whether it will make its appearance once again next session remains to be seen. As the adoption of such an act would undoubtedly make its influence felt on the course of prices of peppermint, parties interested in this article will follow the fate of the bill with particular attention.

According to K. Irk,[19] the Japanese peppermint grows very well in Hungary. He succeeded in propagating slips of *Mentha canadensis* var. *piperascens,* obtained from Berlin-Dahlem in 1911.[20] The oil distilled in 1913 from herb produced by slips had the following properties: $d\frac{25°}{4°}$ 0.8968; $n_{D25°}$ 1.4606; ester v. 196; ester menthol 5.54 p.c.; free menthol 75.58 p.c.; total menthol 81.12 p.c. The herb grown from seeds yielded an oil showing $a_D - 34.14°$ and containing 76.01 p.c. of total menthol. As will be seen, plants grown from seed contain less menthol than those reared from slips.

CURRENT LITERATURE.

Experiments with House-fly Baits and Poisons.

A. W. Morrill (*Jour. Econ. Ent.,* 7 (1914), No. 3, pp. 268–274) has conducted a number of experiments and draws the following conclusions: Vinegar in itself is an excellent bait for a fly trap, but when used with sugar or bread its attractiveness to flies is greatly increased. Equal parts of vinegar, sugar, and water appear to be approximately as attractive as equal parts of sugar and vinegar. An attractive combination poisonous to flies can be made with formalin and vinegar, but further tests are necessary to determine the best proportions. Formalin (40 per cent.) differs greatly on different days in its attractiveness to flies. This variation is evidently not due directly to temperature conditions, and it suggests the possibility of the flies themselves differing from day to day in the degree of the

[19] *Pharm. Zentralh.,* **55** (1914), 459. See also p. 65 of this *Report.*
[20] *Comp. Report,* April, 1911, 92.

sensitiveness of the sensory organs. . . . Beer, milk, and bread, in the order named, are excellent materials to use with formalin, increasing its attractiveness many times. . . . Commercial alcohol (95 per cent.) and water at the rate of 1 : 20 appears from the experiments to be of about equal value with formalin and water mixed at the rate of 1 : 10, both as to attractive power and killing effects.

COLORS IN FOOD.

Food Inspection Decision 76 is hereby amended by striking out of the list of permitted dyes contained therein the words:

Yellow shade:

4. Naphthol yellow S.

and substituting therefor the words:

Yellow shades:

4. Naphthol yellow S.
94. Tartrazine.

Food Inspection Decisions 117 and 129 are also amended so that, hereafter, the coal-tar dyes which may be used in food, subject to the provisions of Food Inspection Decisions 76, 117, and 129, shall be the following:

Red shades:

107. Amaranth.
56. Ponceau 3 R.
517. Erythrosine.

Orange shade:

85. Orange I.

Yellow shades:

4. Naphthol yellow S.
94. Tartrazine.

Green shade:

435. Light green S. F. yellowish.

Blue shade:

692. Indigo disulfoacid.

W. G. MCADOO,
Secretary of the Treasury.
D. F. HOUSTON,
Secretary of Agriculture.
WILLIAM C. REDFIELD,
Secretary of Commerce.

WASHINGTON, D. C., January 11, 1916.

CHEMICALS, DRUGS, AND DYES IN AMERICAN IMPORT TRADE.

Imports of chemicals, drugs and dyes into the United States showed an aggregate value of $5,709,141 during November and of $75,851,879 during the eleven months ending with November, 1915, thus making the year's indicated total approximately $80,000,000, compared with $87,675,573 in 1914 and $101,292,697 in 1913. The following table, compiled by the Bureau of Foreign and Domestic Commerce, Department of Commerce, compares the imports during eleven months of 1915 with a like period of 1914 and indicates the extent to which quantities in most lines have fallen off and prices risen during the past year. Argols and gums are the only important exceptions to the rule of diminished quantities of imports in this group.

ELEVEN MONTHS' IMPORTS OF CHEMICALS, DRUGS, DYES, AND MEDICINES.

Articles imported		1915 Quantities, in millions	1914 Quantities, in millions	1915 Values, in millions	1914 Values, in millions
Acid, Carbolic	Pounds.	1.9	6.5	$0.1	$0.4
Acid, Oxalic	Pounds..	1.9	7.8	.1	.4
Alizarin	Pounds..	3.1	4.2	.8	1.2
Argols	Pounds..	28.5	25.1	3.2	2.7
Arsenic and orpiment	Pounds..	3.3	3.9	.1	.2
Cinchona bark	Pounds..	3.6	3.6	.5	.5
Cinchona alkaloids	Ounces..	1.1	2.5	.5	.6
Aniline salts	Pounds..	.3	2.1	.1	.2
Coal tar colors	..	..	..	3.2	6.4
Coal tar distillates	..	..	..	.7	1.3
Creosote	Gallons..	34.1	47.2	2.7	2.9
Extract, quebracho	Pounds..	80.5	98.9	3.0	2.7
Extracts, other tann'g	Pounds..	5.4	7.4	.2	.2
Fusel oil	Pounds..	3.6	3.4	.9	.5
Glycerin, crude	Pounds..	15.2	24.3	1.9	3.1
Camphor, crude	Pounds..	3.0	3.2	.8	.9
Camphor, refined	Pounds..	1.0	0.9	.3	.3
Chicle gum	Pounds..	7.4	5.5	2.7	2.0
Copal, kauri and damar	Pounds..	28.8	26.5	2.5	2.8
Gambier (Terra Japonica),	Pounds..	9.3	11.7	.4	.4
Indigo	Pounds..	6.1	7.8	2.8	1.1
Iodine	Pounds..	.5	.4	1.0	.9
Lactarene or caseine	Pounds..	6.8	9.5	.4	.6
Licorice root	Pounds..	47.8	100.1	1.1	1.8
Lime chloride	Pounds..	7.2	33.0	.1	.3
Lime citrate	Pounds..	8.3	4.2	1.1	.2
Magnesite, calcined	Pounds..	53.5	223.3	.4	1.2
Opium, 9 per cent. or more Morphine	Pounds..	.3	.4	1.6	1.7

ELEVEN MONTHS' IMPORTS OF CHEMICALS, DRUGS, DYES, AND MEDICINES. (*Continued.*)

Articles imported		1915 Quantities, in millions	1914 Quantities, in millions	1915 Values, in millions	1914 Values, in millions
Potash salts	Pounds..	14.2	28.3	.8	1.2
Sodium nitrate	Tons..	.7	.5	21.6	14.5
Sodium cyanide	Pounds..	4.2	(a)	.7	.4
Sodium salts, other	..	..	..	.4	.6
Sumach	Pounds..	14.5	12.1	.3	.3
Vanilla beans	Pounds..	.8	.8	1.3	2.1

(a) For six months to December 31, 2.4 millions.

There were also imported during eleven months of 1915, 53,513 tons of logwood, valued at $725,000, against 32,430 tons, value $410,000, in 1914; and 19,555 tons of other dyewoods, value $300,000, as against 7743 tons, value $116,000, in the same period of 1914.

SECOND PAN-AMERICAN SCIENTIFIC CONGRESS.

ABSTRACTS OF PAPERS ON APPLIED CHEMISTRY.

TANNING MATERIALS FROM NATIVE SOURCES IN LATIN-AMERICAN COUNTRIES.

By THOMAS H. NORTON.

The growing scarcity of tanning materials in all countries of the North Temperate Zone has given rise to much anxiety as to what sources of tannin may be available in the early future. The attempt is made in this paper to catalogue and classify all of the tanniferous trees and plants of Latin America which promise to be eventually of industrial value. It is found that the flora of that section of the globe includes no less than 143 such sources of tannin, nearly all of which contain higher percentages than the oak or the chestnut.

The list embraces 12 woods, 102 different barks, 9 varieties of leaves, 3 roots, and 17 varieties of fruit and seeds. Among the woods, the quebracho of Argentina and Paraguay stands preëminent. The value in 1913 of the annual export of logs and of extract was $9,963,000, divided equally between the two forms. The supply is practically inexhaustible. Were quebracho capable, alone, of producing good grades of all varieties of leather, the problem of the world's supply for many years to come might be considered as solved; but it can yield good results only when used with other tanning materials.

Of the latter, the most important at the present time are the

mangrove bark of Colombia, Venezuela, and Brazil; the cascalote, divi-divi, and similar pods of Colombia and Mexico; the canaigre and sumach of Mexico; the algarobilla of Chile; and the rhatany of Peru. All of the above sources are capable of extensive development.

The barks of the vast forests of Argentina, Brazil, and Paraguay seem destined to become in the near future one of the world's leading sources of tannin. There is in them a great diversity of forms of tannin, providing for all needs, and, besides, the tannin content of many varieties is far superior to the average percentages present in the oak barks, and the hemlock bark of North America and Europe.

The different trees and plants susceptible of furnishing tannin in commercial quantities are described in detail.

The monograph offers the first comprehensive survey of the tanniferous flora of Latin America.

DYESTUFFS FROM MATERIALS NATIVE TO LATIN-AMERICAN COUNTRIES.

By SAMUEL P. SADTLER.

This paper deals with the extraction of dyes from vegetable and animal sources, such as dyewoods and certain color-yielding insects, as over against the manufacture of the synthetic or coal-tar dyes. Neither in Latin America nor in North America has the synthetic dye-color industry as yet been established upon so firm a commercial basis as to enable it to compete with the European dyestuff industry, although the present great war in Europe may, among other results, bring about such a result upon this side of the Atlantic.

The use of dyes of vegetable and animal origin long antedated the use of the synthetic dyes, and, indeed, down to the middle of the last century, when in 1856 Perkin discovered mauve, the first of the aniline dyes, the former were alone available.

The vegetable sources of the natural dyes are trees, shrubs, leaves and roots of plants. From these the dyestuffs are extracted by water or aqueous solvents, either with or without previous fermentation to decompose natural combinations like glucosides and liberate the dyestuff proper. These dyewoods and dye-yielding plants almost without exception are natives of tropical and semitropical countries, and some of the most important of them are especially to be found as natives of the Latin-American countries.

In taking up the vegetable and animal dyestuffs obtained from materials native to Latin-American countries from review, they are

grouped according to color and their nature and occurrence described, together with their general uses. A table of natural dyestuffs with the artificial colors that have been used as substitutes, whether because of cheaper prices or their being faster to light and the action of reagents, is also given at length, as well as figures on production and imports into the United States.

THE NITRATE INDUSTRY.

By Enrique Cuevas.

Caliche, the raw material from which the nitrate of commerce is extracted, was discovered in the great desert of northern Chile by the Indians some time in the seventeenth century. The first nitrate company was organized in 1812 with very crude reduction methods employed. The present era in the industry dates from 1855 with the introduction of steam as a means of heating and evaporating the solutions.

In 1873 the Peruvian Government assumed a monopoly of the nitrate lands and made grants in a careless manner. This led to much difficulty encountered by Chile when that country was left in possession of this area at the close of the Pacific war. However, titles have since been generally cleared up and beneficial laws enacted, covering not only the matter of land disposal, but of labor and other important questions.

According to the latest official report of the inspector-general of the nitrate deposits, the zone of nitrate-bearing ground comprises 200,000 square kilometres, of which less than 3 per cent. has been surveyed and prospected. In this surveyed portion alone there remains enough nitrate to supply the world for an additional 100 years, measured at the present rate of production. These calculations have been made on an extremely conservative basis, and take no account whatever of known areas of low-grade material.

The industry is divided into two principal operations: (1) mining and transportation of the crude material, and (2) production of nitrate. Methods employed in both branches leave room for improvement. Under present practice, considering average value of raw material, wages, etc., the cost of producing commercial nitrate is estimated at 50 cents United States currency per quintal (101.44 pounds).

Trade specifications require a content of nitrate of sodium equal to at least 95 per cent. This is used as a fertilizer. The refined prod-

uct, with over 96 per cent. nitrate of sodium, is applied in manufacturing uses, such as glass, explosives, fusing mixtures, nitric acid, etc.

There can be no competition between Chilean nitrate and atmospheric nitrate under any conditions which may be foreseen at present. The deposits of the great Pampa Salitrera (nitrate plain) are too vast and the business of manufacturing and marketing the material is too well systematized, whereas atmospheric-nitrate manufacture exists under too many limitations.

A natural reduction in nitrate production has followed the outbreak of the European war, many of the important consuming markets having been cut off.

The author has appended detailed data regarding nitrate production, method of transacting nitrate sales, results of experiments showing the advantages of using nitrate of sodium as a fertilizer, with special reference to crops raised in the United States, and other items of value covering the entire field.

PETROLEUM AND ASPHALT IN THE UNITED STATES.

By E. W. SHAW.

Petroleum is found in the United States in three general regions, eastern, south-central, and western, each of which has access to the sea by one or more pipe lines. The bulk of it is found 800 to 2500 feet below the surface, and more of it is below than above sea level. Its relations to rock pores, to hydraulic forces, and to the chemical nature of the rocks involve most interesting scientific problems. Geology is being found of considerable use in the search for petroleum, the most important and generally applicable principle being that more oil is found on anticlines than in synclines.

The oil shows great variety. Some has little or no asphalt or objectionable sulphur, and others much. Some is dark and heavy, and some transparent and light. Most of the oil is refined by distillation, but processes are coming into general use which involve chemical changes, leading to increased percentages of lighter and more valuable products.

The annual production is steadily increasing, and now (1915) amounts to nearly 300,000,000 barrels; California is the leading state, but others are close competitors. Of this amount 4,000,000 or 5,000,000 barrels are exported in an unrefined condition. The exports of refined products amount to over 5,000,000 barrels a year. New pools are continually being discovered, but the supply of petroleum

is obviously not inexhaustible, and perhaps in less than a century the demand will greatly exceed the output and prices will be forced to much higher levels. With higher prices no doubt more careful methods of production and handling will be put into use.

Asphalt is of comparatively minor importance, though it is widely distributed. Most of the home-produced asphalt is a residue from oil refining.

CHEMICAL RESEARCH AS A DIRECTING AID IN THE EFFICIENT UTILIZATION OF PINE FORESTS.

By CHARLES H. HERTY.

The pine forests of the southern United States present unusual features because the long-leaf pine is the source of turpentine and resin. The resinous character of the pine led to the belief, until recent years, that it was unsuited to the manufacture of pulp and alcohol. This belief led to prodigal waste.

As the exploitation of the forests spread from the Atlantic seaboard into Florida and the more western states it began to be apparent that complete destruction of a great natural resource was imminent, and heed was given to the criticism of a chemist that in the methods employed for the collection of crude turpentine the trees were injured, and there was a diminution in the amount of turpentine recovered as well. Tests conducted by the United States Forest Service showed that trees correctly cut yielded 25 per cent. more product. The results were the replacement of the " box " system by the " cup and gutter " system of collecting, and other important improvements. In carrying out the experimental work which demonstrated the waste in the old process the strictest methods of laboratory research were followed.

The trees or parts of them which fall to the ground are also sources of resinous products. The addition of the wood-pulp feature promises a successful settlement of the industry of extracting products from this " lightwood," of which 2,500,000 cords are formed annually in the long-leaf pine forest, aside from the pine stumps.

It has been shown that the long-leaf pine is suitable for paper manufacture and that sawdust has been utilized under boilers; but greater advancement is promised by results of chemical research, and the commercial application of these results has already begun.

In the light of the accumulated results of such research the waste in former commercial utilization of pine forests is almost unbeliev-

able. The lack of knowledge and economic conditions provided some excuse for the losses of the past, but the nation of to-day will be profligate which fails to utilize to the fullest extent up-to-date methods in the exploitation of the pine forests.

FOOD AND EFFICIENCY.

By H. W. WILEY.

The human body is a chemical laboratory in which all the reactions that take place are capable of exact measurement. Just as the efficiency of a steam engine depends upon the perfection of its work and the character of the fuel, so does the efficiency of the human body depend upon the perfection with which it is elaborated and built and the character of the food which activates it and provides it with heat and energy. The perfection of the building of the human body depends, first of all, upon the proper nutrition of the infant and the child. The chemist has determined by careful experimental work the nature of the fuel required for activating the human engine, and has established the proportions in which the various components of the fuel should be administered to secure the greatest efficiency.

As the object of every life is efficient work, the good condition of the machine is fundamental in securing individual efficiency. Of all the factors that tend to interfere with physical efficiency, bad food is the most dominant. If infants and children are not well fed their teeth are imperfectly formed. The fearful ravages in individual efficiency effected by bad teeth are not at all appreciated as they should be. If we were conscious of the damage that imperfect teeth are doing we would use every endeavor to have the threatening danger removed.

The introduction into every home of a proper diet would do much toward warding off disease, establishing stability of the physical frame, and improving intellectual and moral attitudes. It would also make more efficient men and women, promote happiness and welfare, and prolong life.

Those who desire to see a prosperous country devote themselves with all ardor to improving the character of the food supply and excluding from consumption the alcohol, tobacco, and other drugs which so debase both body and mind. To this end the chemist is constantly working in his laboratory and through his investigations making it possible to so order human diet as to secure the maximum of human efficiency.